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CROSS CONNECTIONS, BY-PASSES AND EMERGENCY INTAKES ON PUBLIC WATER SUPPLIES[1]

The importance of giving increased recognition to the casual and indirect methods of impairing the quality of a water supply, or to the occasional and emergency situation whereby the public water supply may become unsafe, is stressed in this committee report of the State Sanitary Engineers Conference. With the public water supplies rapidly reaching a generally safe, sanitary quality, it becomes steadily more important that the water furnished cities be protected from incidental or accidental infection through ways that some would consider more or less remote. The part played by cross connections, by-passes and emergency intakes on public water supplies in the production of the typhoid fever rates of American cities has been overshadowed by the typhoid fever caused by the usual impurity of the water supplies or by the common prevalence of other insanitary conditions producing typhoid. The improved sanitation of our cities and the better quality of our water supplies, which have made it possible to obtain the very low typhoid death rates of the last few years, will make more evident the effect of the ever present hazards, though only sporadically encountered, that are inherent in these physical connections to dangerous water supplies.

The Committee secured data from thirty State Departments of Health concerning their procedure and attitude on these devices. The great majority of the states had no defined policy on the problem of permitting or supervising these devices. Only a few states have made any investigations or studies in this connection. But fifteen states could give figures on the number of public water supplies having by-passes, emergency intakes or cross connections. Three states have specific regulations against cross connections, while ten other states report their opposition to any form of cross connections. Replies from ten cities, among the largest in the country, to a questionnaire sent in 1918, showed these cities to be unanimously opposed to any kind of cross connections.

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[1] An abstract of a report on the subject by a committee of the Conference of State Sanitary Engineers. The abstract was prepared for the Journal by S. Pincus, chairman of the committee, of which the remaining members are C. A. Emerson, W. H. Dittoe, H. F. Ferguson and M. Z. Bair.

Twenty outbreaks of typhoid fever, dysentery or gastro-enteritis, occurring in eleven states in recent years were caused by cross connections (11), by-passes (4) or emergency intakes (5). Outbreaks of disease were reported where cross connections had been provided with a check valve and gate valve.

The Committee urges the need for the fixing of a definite and secure policy upon these connections to the public water supplies in every state, and has recommended the following definitions and principles for guidance in the establishment of such policies.

A. CROSS CONNECTIONS: A *cross-connection* is a physical arrangement whereby a public water supply system is connected with another water supply system, either public or private, in such a manner that a flow of water into such public water supply system from such other water supply system is possible.

Principle no. 1. No *cross-connections* should be established or maintained between the public water supply system and any other water supply system, private or public, unless both water supplies are of safe sanitary quality and both supplies and the connection thereof have received the approval of the State Health Department.

Principle no. 2. In cases where it is necessary or advisable to supplement an impure private water supply with the public water supply distributed in the same piping system, the public supply must be made available by delivering it into a cistern suction well or elevated tank, at an elevation above the high water line of such cistern, suction well or tank.

RECOMMENDED MODIFICATIONS OF ABOVE PRINCIPLES FOR TEMPORARY APPLICATION UNDER EXCEPTIONAL CIRCUMSTANCES

While the Committee is of the opinion that full safety demands such complete separation of the public water supply system from other water supply systems delivering impure water, the Committee recognizes the relative degree of safety which can be provided by suitable check valve installations on connections between a public water supply and a piping system used for fire protection only.

The Committee is cognizant of the fact that such connections may be proper and reasonable under certain conditions, and desires to express the following requirements which should be met in making and maintaining such installations:

1. Cross-connections should not be permitted where the available public water supply or private fire protection supply is adequate for fire protection purposes.

2. That the fire protection piping system shall not be connected with any other piping system upon or within the property served, and that there shall be no outlet from such fire protection piping system except through sprinkler head, fire plugs and hose connections. This requirement is intended to prevent a flow through check valves except at times when a sprinkler head, fire plug or hose connection is open.

3. The cross-connection shall be equipped with such devices as can most effectually prevent an inflow of water from the fire protection system to the public water supply system.

4. The Committee is of the opinion that the most efficient and dependable device developed up to date (aside from the method described in principle no. 2 above) is the check valve installation recommended by the Associated Factory Mutual Fire Insurance Companies of Boston, Mass., consisting of two gate valves with indicator posts, two check valves of the Factory Mutual type, with drip cocks and gauges for testing, an alarm valve equipped with a recording pressure gauge, a by-pass meter around the alarm valve, all to be placed in a vault of water-tight construction accessible to ready inspection.

5. A systematic test inspection of the cross-connection, including periodic examination of the interior of the check valves by the Department in charge of the public water supply system, must be provided, without which inspections the installations of the cross-connection would be a highly dangerous health menace. The inspection must therefore be made reliable, thorough and responsible.

6. The Committee views as a self-evident requirement that in every case where a cross-connection is being considered for approval a thorough investigation will be made as to local conditions and as to the necessity and advisability of the cross-connection, and that the local municipal officials will be made fully acquainted with the circumstances and given due opportunity for presenting their views.

B. BY-PASSES: A *by-pass* is a physical arrangement whereby water may be diverted around any feature of a purification process of a public water supply.

Principle no. 1. No *by-pass* should be established or maintained whereby water may be diverted around any feature of a purification process of a public water supply system, provided that with the specific approval of the State Department of Health *by-passes* may be permitted around primary sedimentation basins, aerators or mixing chambers.

Application recommended

Where there are existing by-passes, except as provided above, the correction should be obtained by the complete removal of the by-passes or the removal of a section of the by-pass piping

C. Emergency Intakes: An *emergency intake* is an intake or other device capable of introducing water into the public water supply system from a source of supply which, because of its unsafe characteristics, has not been approved for ordinary use by the State Department of Health.

Principle no. 1. No *emergency intake* should be established or maintained in connection with a public water supply system.

Application recommended

Where emergency intakes are in existence and where the regular water supply is adequate and the emergency intake can be safely removed, the emergency intake should be completely taken out so as to be unavailable for use.

Where the regular water supply system is not adequate and the maintenance of an emergency intake is conclusively necessary, it is obvious that such intakes must be continued, but should be under the complete supervision of the State Department of Health so that the intakes will not be used except under conditions constituting an emergency. During the continuance of the emergency intake, the State Department of Health should make every effort to obtain the enlargement of the existing water supply plant so that the emergency intake may be removed at the earliest possible time.

For the maintenance of an emergency intake, under the above mentioned circumstances, the following safeguards should be adopted and enforced:

1. (a) The water-tightness of the valve on the emergency intake connection should be tested and the valve sealed by the State Department of Health or (b) the valve should be sealed and a section of the intake piping should be removed, making it necessary to replace the pipe section before the intake is available.

2. Provision must be made for the chlorination of any water taken through the emergency intake before delivery is possible to the distribution system.

3. Whenever it becomes necessary to open the emergency intake, the water works official must give immediate notice, if at all possible, preliminary to the opening of the intake, to the public affected and to the state and local health officials. The disinfection equipment should be placed in service immediately and a warning given to boil all water used for drinking and domestic purposes. Such warning should be continued until the emergency intake is again closed and sealed, and the water supply system cleansed and declared safe by the State Health Department.

The report of the Committee was adopted by the Conference of State Sanitary Engineers with no opposing vote, on June 1, 1921 at the Convention in Boston, Mass.